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NASA TECH BRIEF

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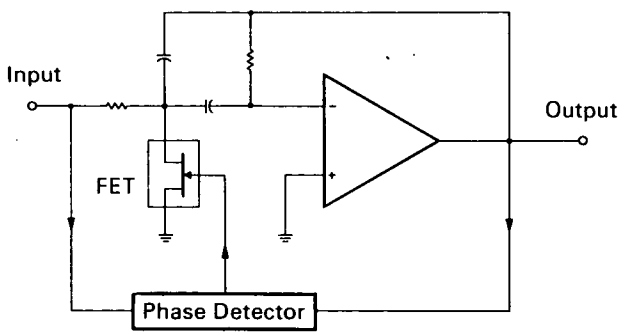
A Self-Tuning Filter



Circuit Diagram of Self-Tuning Filter

The problem:

Bandpass filters are commonly used in electronic systems to improve the signal-to-noise ratio. If the frequency of the input signal is variable, as it is from many types of vibrating transducers, a wideband filter is frequently used to avoid signal attenuation and phase shift at the frequency extremes, and the filtering is then not as effective in rejecting noise.

The solution:

A self-tuning filter that automatically adjusts its center frequency to track the signal frequency. This technique permits the use of a filter with a bandwidth considerably smaller than the range of input signal frequencies.

How its done:

A resistance-capacitance bandpass filter whose center frequency can be varied by means of a single resistive element is used. However, instead of an ordinary resistor, a field effect transistor (FET) is used so that the voltage of the tuning element can be controlled. The control voltage is derived from a phase detector which compares the phase of the filter input and output. If the phase between the input and output is 180°, the filter is tuned to the input frequency. If the phase is less than 180°, a correcting voltage is applied to the FET to retune the filter until the phase is 180°, at which time the filter is again in tune. A circuit diagram of the self-tuning filter is shown in the figure.

A reference frequency is not required as in lock-in amplifier filters. Also, there is no change in phase as the signal frequency varies. A self-tuning filter that covers the range from 2 kHz to 20 kHz, while maintaining constant bandwidth and center frequency gain, has been built. It can be made to cover other decades of frequency by switching capacitors.

Note:

Requests for further information may be referred to:

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Reference: B70-10337

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to National Aeronautics and Space Administration, Code GP, Washington, D.C. 20546.

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Category 01

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